TWO-CHANNEL DIGITAL-TO-ANALOGUE METER WITH MULTICOLOUR BARGRAPHS + SERIAL INTERFACE

NA6

USER'S GUIDE

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Two-channel digital-to-analogue meter with multicolour bargraphs + serial interface

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1. APPLICATION

NA6 series meters with multicoloured bargraphs have an universal input destined to measure temperature, resistance, voltage from shunts, standard signals, d.c. voltage and d.c. current.

They can find application in various industrial fields, e.g. food industry, intermediate pumping stations, sewage treatment plants, chemical industry, weather stations, breweries.

They are destined for the visualisation of the measured value and evaluation of change trends of checked technological processes. They can also find application in automation systems where programmed controllers are applied.

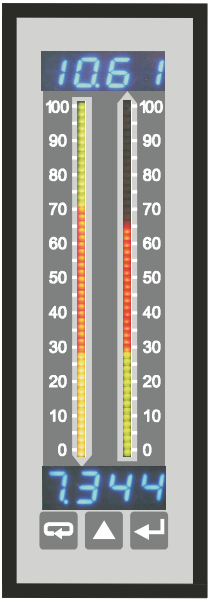


Fig.1. View of the NA6 meter.

NA6 meters can have in option: a continuous analogue output, a relay output, open collector (OC) type outputs and an RS-485 digital output.

They are programmed by means of the keyboard and through RS-485.

NA6 meters realise following functions:

- measurement of the input quantity and displaying it on the display and the bargraphs,
- recounting of the input signal into indication on the base of the individual linear characteristic,
- arithmetical functions on channels: addition, subtraction, multiplication, division, raising to a power, extraction of roots,
- programming of colours and bargraph resolutions,
- signalling of alarm value setting exceedings,
- recording of the measured signal in programmed time segments,
- storage of maximal and minimal values,
- programming of the measurement averaging time,
- programming of the indication resolution,
- deadlock of the parameter introduction by means of a password,
- conversion of the measured quantity into a voltage or current output signal,
- service of the RS-485 interface in MODBUS protocol, both in ASCII and RTU mode.

2. SET OF THE NA6 METER

We deliver in the set:

- NA6 meter	1 pc.
- user's guide	1 pc.
- guarantee card	1 pc.
- plug with screw terminals	1 or 2 pcs (depending on execution)
- holders to fix the meter in the panel	2 pcs
- set of stickers with units	1 pc.

When unpacking the meter, please check whether the type and execution code on the data plate correspond to the order.

3. BASIC REQUIREMENTS, SAFETY INFORMATION

Symbols located in this service manual mean:

WARNING!

Warning of potential, hazardous situations. Especially important. One must acquaint with this before connecting the NA6 meter. The non-observance of notices marked by these symbols can occasion severe injuries of the personnel and the damage of the instrument.

CAUTION!

Designates a general useful note. If you observe it, handling of the meter is made easier. One must take note of this when the instrument is working inconsistently to the expectations.

Possible consequences if disregarded !

In the security scope the meter meets the requirements of the EEC Low-Voltage directive (EN 61010 -1 issued by CENELEC).

Remarks concerning the operator safety:

1. General

- The NA6 meter is destined to be mounted on a panel.
- Non-authorized removal of the required housing, inappropriate use, incorrect installation or operation creates the risk of injury to personnel or damage to equipment. For more detailed information please see the user's guide.
- All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel and national regulations for the prevention of accidents must be observed.
- According to this basic safety information, qualified, skilled personnel are persons who are familiar with the installation, assembly, commissioning, and operation of the product and who have qualifications necessary for their occupation.

2. Transport, storage

Please observe the notes on transport, storage and appropriate handling. Observe the climatic conditions given in Technical Data.

3. Installation

- The NA6 meter must be installed according to the regulation and instructions given in this user's guide.

- Ensure proper handling and avoid mechanical stress.
- Do not bend any components and do not change any insulation distances.
- Do not touch any electronic components and contacts.
- Instruments may contain electrostatically sensitive components, which can easily be damaged by inappropriate handling.
- **Do not damage or destroy any electrical components since this might endanger your health!**

4. Electrical connection

- Before switching the meter on, one must check the correctness of connection to the network.
- In case of the protection terminal connection with a separate lead one must remember to connect it before the connection of the instrument to the mains.
- When working on live instruments, the applicable national regulations for the prevention of accidents must be observed.
- The electrical installation must be carried out according to the appropriate regulations (cable cross-sections, fuses, PE connection). Additional information can be obtained from the user's guide.
- The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must be observed for all CE-marked products.
- The manufacturer of the measuring system or installed devices is responsible for the compliance with the required limit values demanded by the EMC legislation.

5. Operation

- Measuring systems including NA6 meters must be equipped with protection devices according to the corresponding standard and regulations for prevention of accidents.
- After the instrument has been disconnected from the supply voltage, live components and power connections must not be touched immediately because capacitors can be charged.
- The housing and the door must be closed during operation.

6. Maintenance and servicing

Please observe the manufacturer's documentation.

Read all product-specific safety and application notes in this user's guide manual

- Before taking the meter housing out, one must turn the supply off.
- The removal of the instrument housing during the guarantee contract period may cause its cancellation.

4. INSTALLATION

4.1. Fitting

Prepare a ($44^{+0.5}$ x $137.5^{+0.5}$) mm hole in the panel. The thickness of the material from which the panel is made should be in the range 1...45 mm.

The meter has screw terminal strips which enable the connection of 2.5 mm^2 cross-section external conductors.

Meter dimensions are shown on the fig. 2.

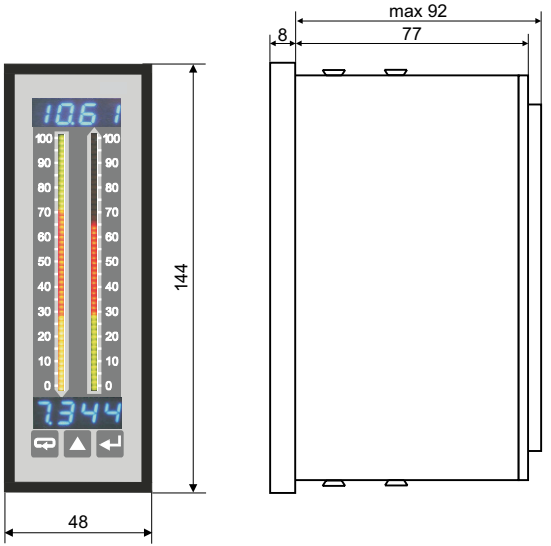


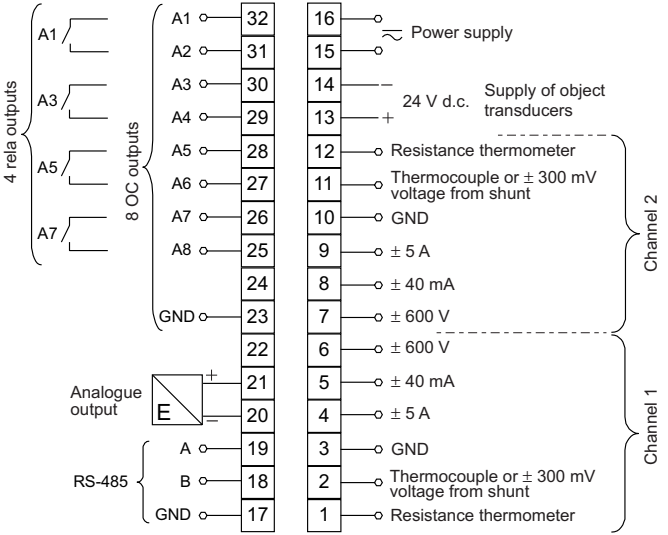
Fig. 2. Meter overall dimension

4.2. External connection diagrams

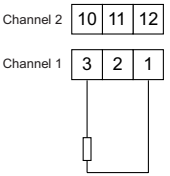
The description of terminal strips are shown on the fig. 3a.

Connections of input signals are shown on the fig 3b and output signals on fig. 3c and 3d.

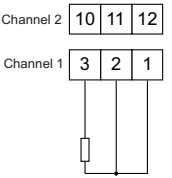
The meter has programmable inputs. Maximal measuring ranges are given on figures.



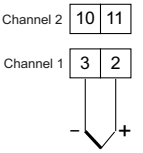
a/ Description of the terminal strip



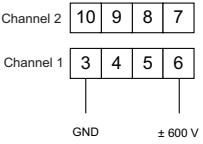
Resistance thermometer in two-wire system or resistance measurement



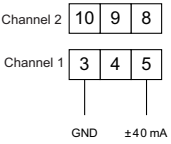
Resistance thermometer in three-wire system



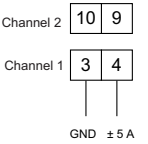
Thermocouple
or
± 300 mV voltage



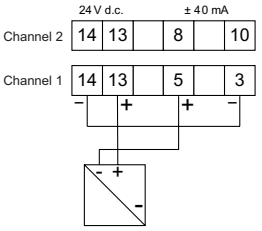
± 600 V voltage input



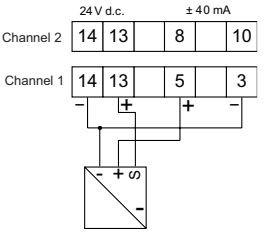
± 40 mA current input



± 5 A current input

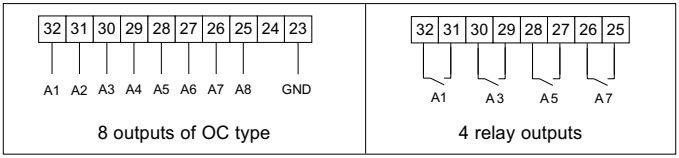


Two-wire object transducer

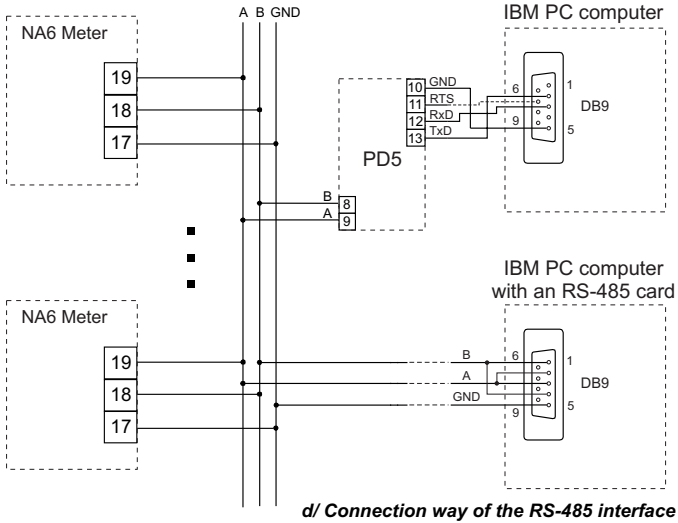


Three-wire object transducer

b/ Connection way of input signals



c/ Connection way of digital and analogue output signals depending on the execution code



d/ Connection way of the RS-485 interface

Fig.3 External connections of the NA6 meter

Taking into consideration electromagnetic interference it is recommended to use shielded conductors for the connection of input and output signals.

The power supply must be connected by means of a two-wire conductor with a suitable cross-section ensuring its protection by means of an installation fusible cut-out, in case of a short-circuit. Requirements concerning the supply cable are regulate by EN 61010-1 p.6.10 standard.

5. SERVICING

After connecting external signals and switching the meter on, its name NA-6 and also the current version of the program, e.g. r 100. are displayed.

After ca 3 seconds, the meter transits automatically into the working mode in which it carries out the measurement and the display of the measured value on the display and the bargraph.

Depending on alarm parameter settings, the resolution and bargraph type, alarm thresholds are also displayed on the bargraph.

The meter blanks automatically insignificant zeros.

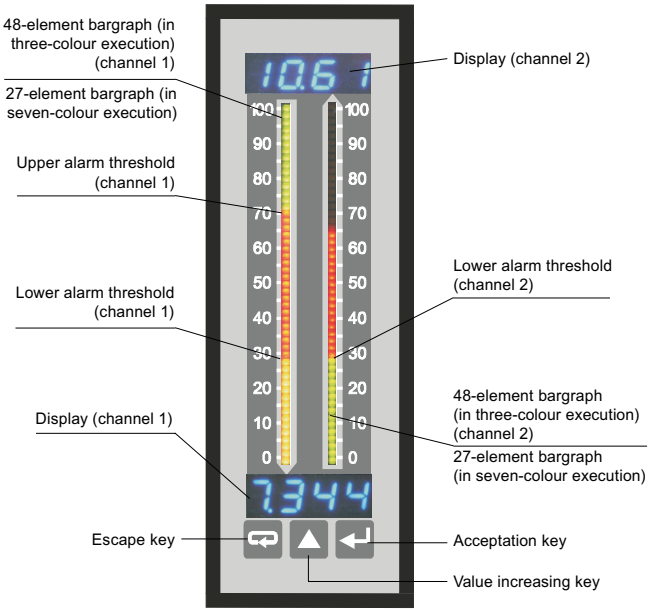


Fig. 4 Description of the NA6 frontal plate.

Key functions:

- acceptation key

- entry into the programming mode (hold down during ca 3 seconds),
- entry into the chosen parameter level,
- entry into the changing mode of the parameter value,
- acceptation of the changed parameter value.

- Key to increase the value

- display of the minimal value (first pressure), maximal (second pressure), return to measurement (third pressure),
- mowing on the preview menu or programming matrix,
- change of the chosen parameter value - increasing of the value.

- Escape key

- entry into the menu of recording results,
- entry into the preview menu or programming matrix,
- exit from the preview menu or programming matrix,
- escape from the parameter change.

The pressure and hold down the key during 3 seconds causes the entry into the programming mode. The programming mode is protected by the SEC safety code.

The pressure and hold down the key during 3 seconds causes the entry into the preview menu and the menu of recorded values. One must move on the preview menu by means of the key. In this menu, only all programmed parameters except servicing parameters, are accessible to readout.

The exit from the preview menu is operated by means of the key. It is also possible in the preview menu to review recorded rESL values.

The pressure of the [↵] key on the rESt parameter causes the entry into the preview menu of recorder values. The recorded result number is displayed alternately with the value e.g. n320/2 174.

The moving on recorded values follows by means of the [▲] key. The pressure of this key longer than ca 2 seconds will cause the acceleration of the review. The pressure of the [↵] key in any moment will cause the lighting of the number of recorded results. The exit from the review of recorded values is operated by means of the [↩] key.

The algorithm of the meter servicing is presented on the fig. 5.

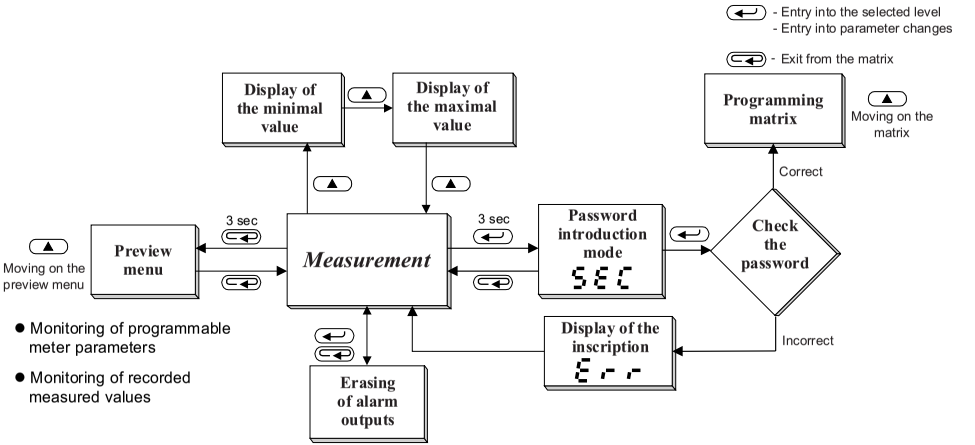


Fig 5. Servicing algorithm of the NA6 meter.

The appearance of the following symbols and inscriptions on the display means:

Incorrectly introduced safety code

Exceeding of the upper measuring range or lack of sensor

Exceeding of the lower measuring range or short-circuited sensor

Error of the conductor resistance compensation. No connected conductor or damaged conductor.

It is possible to change meter parameters:

- from the meter keyboard (p 5.1)
- through RS-485 (p.6.)

5.1. Change of the NA6 meter parameters from the keyboard

The pressure of the ↵ key during circa three seconds causes the display of the SEC.

Inscription alternately with the set zero value by the manufacturer. The introduction of the correct code causes the entry into the programming mode. The fig.6 represents the transition matrix into the programming mode. One can move on groups of main parameters eg: **Ch1**, **Ch2**, **bAr1**, **bAr2**, **Al1**, **Al2**, etc, by means of the ▲ key.

The pressure of the ↵ key on the given level, causes the entry into parameters of this level. The moving on the given level is operated by means of the ▲ key.

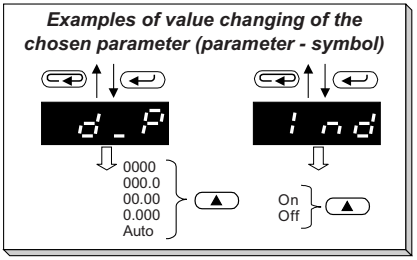
In order to change the value, one must use the ↵ key. In order to escape from the parameter change, one must press the ↩ key.

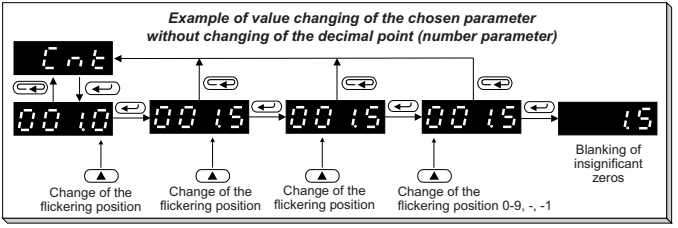
By means of the ↩ key, one can exit from the selected level and programming matrix to the measurement.

During the meter operation in the programming mode, the measurement result is displayed on the bargraph, excepting the function of the display test selecting.

Lev Nr	Main menu	Parameters of the selected level											
1	Ch1	tYP Input type	Lo in Lower value of input range	Hi in Upper value of input range	Func Mathem. func.	Con Kind of comp.	d_P Decim. point	Cnt Meas. time	inPt Input ind. charact.	i_Hi Param. of ind. charact.	d_Yi Param. of ind. charact.	i_Ho Param. of ind. charact.	d_Yo Param. of ind. charact.
2	Ch2	tYP Input type	Lo in Lower value of input range	Hi in Upper value of input range	Func Mathem. func.	Con Kind of comp.	d_P Decim. point	Cnt Meas. time	inPt Input ind. charact.	i_Hi Param. of ind. charact.	d_Yi Param. of ind. charact.	i_Ho Param. of ind. charact.	d_Yo Param. of ind. charact.
3	bAr1	tYPb Bargr. type	colr Bargr. colour	brl Lower bargr.	brH Upper bargr.								
4	bAr2	tYPb Bargr. type	colr Bargr. colour	brl Lower bargr.	brH Upper bargr.								
5 ÷ 12	AL1 ÷ AL8	ChnA Input channel	Prl Lower threshold	PrH Upper threshold	tyPA Alarm type	dly Alarm delay	Ho.Ho Param. of indiv. charac.	HSUd Alarm support	CurL Lower marker colour	CurH Upper marker colour			
13	Out	ChnO Input channel	indO Input indiv. charac.	d_Hi Param. indiv. charac.	O_Yi Param. indiv. charac.	Hour Time change	CirL Erasing of min. value	CirH Erasing of max. value	bAud Baud rate	tr-Yb Kind of transm.	Adr Device adress		
14	SEr	SEt Param. inscript.	SEC Passw. change	tSt Test of display + bargr.									
15	LOGr	rEC Record.	Cor1 Chan.1 record. start	dAt1 Chan.1 record. date	int1 Chan.1 record. interv.	Cor2 Chan.2 record. start	dAt2 Chan.2 record. date	int2 Chan.2 record. interv.					

Fig. 6. Transition matrix into the programming mode





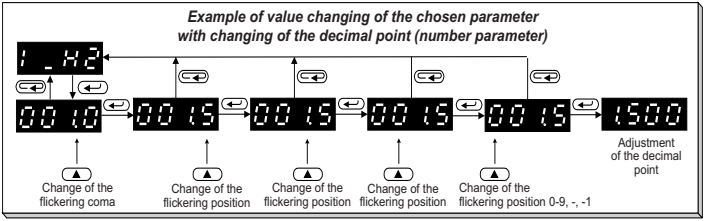


Fig. 7.

Meter programmable parameters are presented in the table 1. The programming of parameters is possible after the previous introduction of the password.

Programmable parameters of NA6 meter Table 1

	Symbol on the display	Parameter description	Range of changes
Input parameter Ch1, Ch2	tYP	**Kind of input**	**Reesistance thermometers:** Pt 1 - Pt100 Pt5 - Pt500 Pt 10 - Pt1000 **Thermocouples:** tE-J - thermocouple, type J tE-h - thermocouple, type K tE-n - thermocouple, type N tE-E - thermocouple, type E tE-r - thermocouple, type R tE-S - thermocouple, type S tE-t - thermocouple, type T rE2 - resistance to 10 kΩ nAPL - voltage to ± 300 mV nAPH - voltage to ± 600 V nnAL - current to ± 40 mA nnAH - current to ± 5 A
	LoIn	**Lower value of the input range** The setting of parameters LoIn and HiIn gives the possibility to narrow the measuring range down.	Setting possibility: -1999...9999 At the input signal < LoIn the meter displays the lower exceeding. The condition LoIn<HiIn must be fulfilled. The parameter does not take into consideration the individual characteristic, is operates on the measuring signal.
	HiIn	**Upper value of the input range**	Setting possibility: -1999...9999 At the input signal > HiIn the meter displays the upper exceeding. The condition LoIn<HiIn must be fulfilled. The parameter does not take into consideration the individual characteristic, is operates on the measuring signal.
	Func	**Mathematical functions made in the channel**	OFF - mathematical functions switched off; SQr - raising to a power $(\text{result})^2$ SQrt - extraction of roots $\sqrt{\text{result}}$ COPY - copying the result $\text{result}_1 \Leftarrow \text{result}_2$ for the channel 1 $\text{result}_2 \Leftarrow \text{result}_1$ for the channel 2

			Add - addition $result_1 + result_2$
			Sub - subtraction $result_1 \Leftarrow result_1 - result_2$ for the channel 1 $result_2 \Leftarrow result_2 - result_1$ for the channel 2
			mnuL - multiplication $result_1 \cdot result_2$
			di u - division $result_1 \Leftarrow result_1 : result_2$ for the channel 1 $result_2 \Leftarrow result_2 : result_1$ for the channel 2
Input parameter Ch1, Ch2	Con	**Kind of compensation** of sensor working conditions changes: - In case of a resistance thermometer and resistance measurement it concerns the compensation of the resistance changes of the conductor linking the sensor with the meter, - In case of a thermocouple it concerns the compensation of reference junction temperature changes.	Auto - automatic compensation (in case of resistance thermometers and resistance measurement it requires a 3-wire line.) **0.0...60.0°C** - value of the reference temperature for thermocouples. **0.0...40.0 Ω** - resistance of two conductors for resistance thermometers and resistance measurement. The writing of a value beyond the interval of manual compensation (e.g. value 70.0) will cause the **automatic compensation** switching on.
	d_P	**Setting of the decimal point**. The setting operates both when the individual characteristic is switched off and on. The introduction of the decimal point making impossible the display of four characters on the display will cause the display of the lower or upper exceeding.	Setting possibility: **0000** **000.0** **00.00** **0.000** Auto - automatic choice of the decimal point
	Cnt	**Averaging time of the measurement.**	**0.0...999.9 s** The writing of 0 causes the switching of the measurement off and the stoppage of the meter operation. In this state, the meter displays the hour. The bargraph is blank.
	Ind1	The switching off or on of the individual linear user's characteristic. - („**individual characteristic of the display**").	On - characteristic switched on, OFF - characteristic switched off.

	I_H1 d_Y1 I_H2 d_Y2	**Parameters of the display individual characteristic**. On the base of given by the user coordinates of two points the meter determines (from the system of equations) a and b coefficients of the individual characteristic. $\begin{cases} d_Y1 = a \cdot I_H1 + b \\ d_Y2 = a \cdot I_H2 + b \end{cases}$ Where: I_H1 i I_H2 - measured value d_Y1 i d_Y2 - expected value on the display. Fig.9 shows the way of the individual characteristic operation.	Setting possibility: **-1999... 9999**

Bargraph Parameters bAr1, bAr2	tYPb	**Bargraph type**	OnEC - „ one colour „ bargraph, InTr - „ interval „ bargraph, SEct - „ sector" bargraph, PInt - „ point bargraph, trEn -"trend" bargraph. Fig. 10 explains bargraph types. .
	colr	**Bargraph colour**	OFF - bargraph switched off, r - red, G - green, rG - red + green other colours are accessible only in meters with a 7-colour bargraph. b - blue, rb - red + blue, Gb - green + blue, rGb - red + green + blue.
	brL	**Parameter to set the „magnifier" on the bargraph. Lower threshold**. Value on the display at which the bargraph is to be blank.	Setting possibility: **-1999... 9999**
	brH	**Parameter to set the „magnifier" on the bargraph. Upper threshold**. Value on the display at which the bargraph is to be lighted.	Setting possibility: **-1999... 9999**

Parameters of alarm 1 to alarm 8 AL 1 to AL 8			
	ChnA	Choice of the channel on which the alarm is to react.	Ch 1 - channel 1 Ch2 - channel 2
	PrL	**Lower alarm threshold**	- 1999... 9999
	PrH	**Upper alarm threshold**	- 1999... 9999
	tYPA	**Alarm type** Fig. 8 shows alarm types	nor - normal, On - switched on, OFF - switched off, H_On - manually switched on. Till the time of the alarm type change, the alarm output is being permanently switched on. H_OF - manually switched off. Till the time of the alarm type change, the alarm output is being permanently switched off.
	dLY	**Delay of the alarm operation.** The parameter is defined in seconds, i.e. one must give the time in seconds after which the alarm will operate after its occurrence. The alarm operation follows after the measurement averaging. The alarm switching off follows without delay..	**0.0... 999.9** Introduction of **0.0** causes the operation at the moment of the alarm occurrence.
	HOLd	Support of alarm signalling. In the situation when the holding function is switched on, after the alarm state stoppage, the alarm is still switched on (relay or OC contacts). The alarm state is active till the moment of erasing it by means of the combination of ↵ and ⮌ keys.	OFF - The maintenance of the alarm output is switched off. On - The maintenance of the alarm output is switched on.

	CurL	**Colour of the lower threshold alarm marker.**	OFF - alarm marker switched off. r - red, G - green, rG - red + green, Other colours are accessible only in meters with a 7-colour bargraph. b - blue, rb - red + blue, Gb - green + blue, rGb - red + green + blue, Fig. 10 explains the idea of CurL and CurH parameters
	CurH	**Colour of the upper threshold alarm marker.**	

Output parameters Out	ChnO	Choice of the channel on which the analog output is to react.	Ch1 - channel 1 Ch2 - channel 2
	IndO	Switching off or on of the individual linear user's characteristic - („**individual characteristic of the analog output**").	On - characteristic switched on, OFF - characteristic switched off . When the characteristic is switched off, the meter operates at the maximal range depending on input and range output.
	d-H1 O-Y1 d-H2 O-H2	**Parameters of the individual characteristic of the analog output**. On the base of given coordinates of two points by the user, the meter determines (from the equation system) coefficients a and b of the individual characteristic. $\begin{cases} O_Y1 = a \cdot d_H1 + b \\ O_Y2 = a \cdot d_H2 + b \end{cases}$ where: d_H1 and d_H2 - displayed value O_Y1 and O_Y2 - expected value on the analog output. Fig. 9 represents the graphical illustration explaining the idea of the individual characteristic.	Setting possibility: **- 1999... 9999**

	baud	**Baud rate of the RS-485 interface**.	2400 - 2400 b/s 4800 - 4800 b/s 9600 - 9600 b/s
	trYb	**Kind of transmission through the RS-485 interface**.	OFF - interface switched off A8n 1 - ASCII 8N1 A7E 1 - ASCII 7E1 A7o 1 - ASCII 7O1 r8n2 - RTU 8N2 r8E 1 - RTU 8E1 r8o 1 - RTU 8O1 r8n 1 - RTU 8N1
	Adr	**Device address**	Setting possibility: 0...247

Servicing parameters SEr	SEt	**Manufacturer's parameters**. Manufacturer's parameters are presented in the table 2.	The pressure of the ↵ key causes the writing of manufacturer's parameters.
	SEC	**Introduction of a new password**.	Setting possibility: **- 1999... 9999**
	tSt	**Test of displays and bargraphs**. The Test consists on a successive display of numbers 1111, 2222 etc. Successive bargraph colours are lighted on the bargraph.	The pressure of the ↵ key causes the test switching on. The pressure of the ↩ key ends the test.
	Hour	**Setting of the current time**. Time format : hh:mm:ss	Setting possibility: **00:00:00 ... 23:59:59**
	CLrL	**Erasing of the minimal value**.	The pressure of the ↵ key causes the erasing of the minimal value from channels 1 and 2.
	CLrH	**Erasing of the maximal value**.	The pressure of the ↵ key causes the erasing of the maximal value from channels 1 and 2.

Recording parameters LOGr	rEC	**Switching the recording on or off**. At the moment of switching the recording on, the meter erases the previous stored values of the channel 1 and 2.	OFF - recording switched off rEc 1 - recording of the channel 1 switched on rEc2 - recording of the channel 2 switched on rE 12 - recording of the channel 1 + 2 switched on
	Gor 1	**Hour of recording start - kanal 1** Time format: hh:mm:ss	Setting possibility: **00:00:00 ... 23:59:59**
	dAt 1	**Date of recording start - kanal 1** Date format: yy.mm.dd It is an information parameter. It not serves to define the date from which the recording is to begin, but only to inform when the recording has began.	Setting possibility: **70.01.01 ... 38.12.31**
	Int 1	**Time interval of recording - channel 1** Defines the segment of time and at which sequence the result will be to memorised. Minimal interval 1 s. Format: hh:mm:ss	Setting possibility: **00:00:00 ... 99:59:59**
	Gor2	**Time of recording start - channel 2** Time format: hh:mm:ss	Setting possibility: **00:00:00 ... 23:59:59**
	dAt2	**Date of recording start - channel 2** Date format: yy.mm.dd It is an information parameter. It is not served to define the date from which the recording is to begin, but only to inform when the recording has began.	Setting possibility: **70.01.01 ... 38.12.31**
	Int2	**Time interval of recording - channel 2** Defines the segment of time and at which sequence the result will be to memorised. Minimal interval 1 s. Format: hh:mm:ss	Setting possibility: **00:00:00 ... 99:59:59**

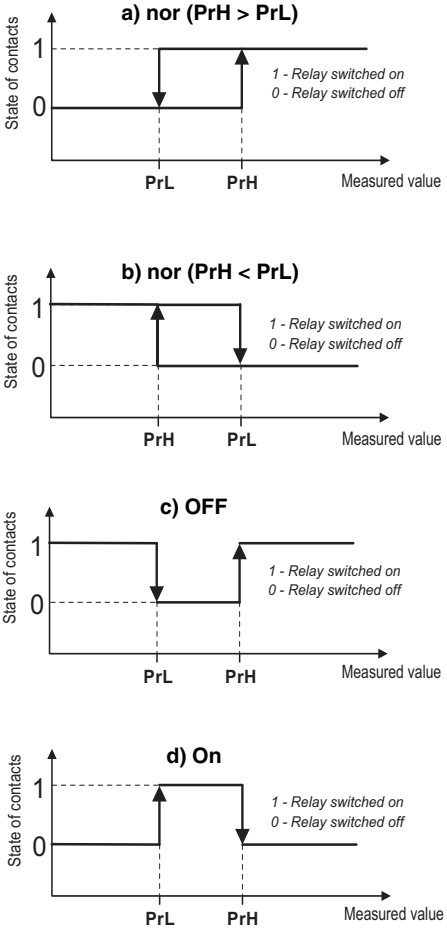
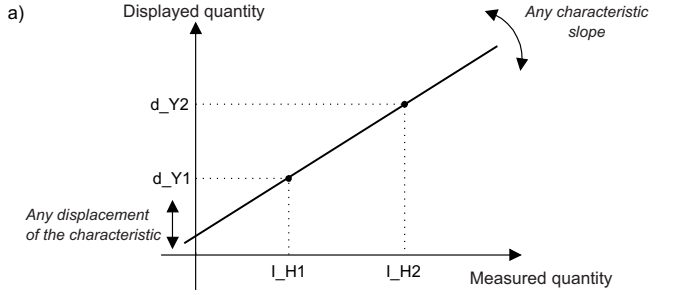
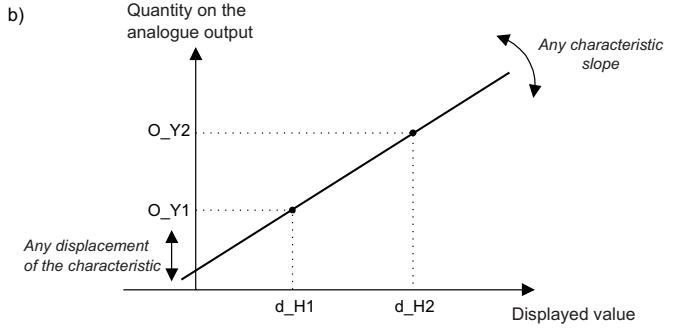


Fig. 8. Alarm types: a, b - normal, c - switched off, d - switched on



Value I_H1 on the meter input => value d_Y1 on the display.
Value I_H2 on the meter input => value d_Y2 on the display
other characteristic points are calculated



Value d_H1 on the display => value O_Y1 on the analogue output.
Value I_H2 on the display => value O_Y2 on the analogue output
other characteristic points are calculated

Fig. 9. a) Individual characteristic of the display, b) Individual characteristic of the analogue output.

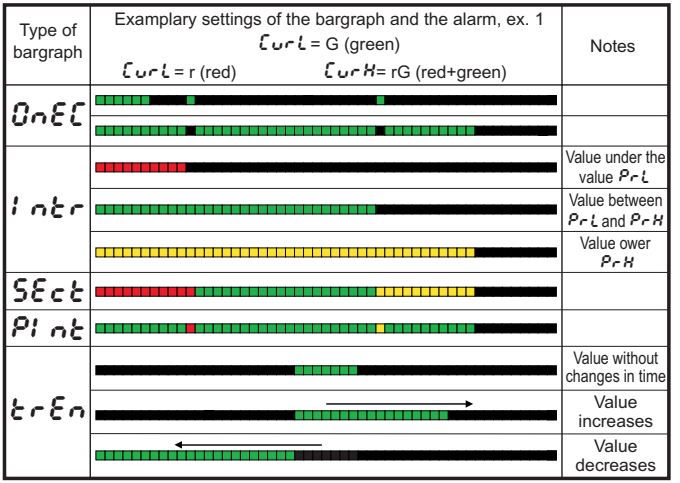


Fig. 10. Bargraph modes.

Notice!

– The meter is working in the measuring range of defined indications by the user in **LoIn** and **HiIn** parameters. Below and over, it shows a range exceeding.

– In case when the meter is working with a resistance thermometer in a two-wire system, the choice of the automatic compensation option of conductor resistance changes will cause a defective meter operation and the display of **ErrC** inscription.

– In case of the display individual characteristic switching on, the result on the display is linearly converted according to the introduced parameters: **I_H1**, **I_H2**, **d_Y1** i **d_Y2**.

– In case of arithmetical functions and individual characteristic switching on, in the first sequence, arithmetical operations will be carried out and the obtained result is converted by the individual characteristic.

– In case of the analog output individual characteristic switching on, the measurement result is linearly converted according to the introduced parameters: **d_H1**, **d_H2**, **O_Y1** i **O_Y2**.

– The meter currently controls the value of the introduced parameter at the moment. In case when the introduced value exceeds the upper or the lower range of changes given in the table 1, the meter will make the parameter record.
– In case of the **Input type** change, a simultaneous change of the decimal point follows, optimally for the given input.
– After the supply decay, the present time is zeroed.
– The recording switching off follows in following cases: switching the recording off from the programming matrix, change of the **input type**, change of the recording time start or the recording time interval, setting **Cnt**=0, filling of the memory, and at a renewed switching of the meter on to the network.
– In case of a bargraph of **Intr** or **Sect** type, it is possible to set only one CurL and Curh markers (from one alarm). Other markers are erased automatically.
– Max and Min values are erased in case of change of input type, individual characteristic (on, off), writing standard parameters in.

Standard parameters of the NA6 meter — Table 2

Parameter description	Standard value	Parameter description	Standard value
tYP	nnAL (± 40 mA)	ChnA	Chn1
Lo In	- 20.0	PrL	- 20.00
Hi In	20.00	PrH	20.00
Func	OFF	tYPA	OFF
Con	0 = manually	dLY	0
d_P	00.00	HOLd	OFF
Cnt	1.0	CurL	r - Alarm 1 and 3 OFF - other alarms
Indi	OFF		
1_H1	0	CurH	rG - Alarm 1 and 3 OFF - other alarms
d_Y1			
1_H2		ChnO	Chn1
d_Y2		IndO	OFF
tYPb	Sect	d_H1	0
colr	G	O_Y1	
brL	- 20.0	d_H2	
brH	20.00	O_Y2	

bAud	9600	Cor 1	00:00:00
trYb	RTU 8N2	dAt 1	70:01:01
Adr	1	Int 1	00:15:00
SEC	0	Cor2	00:00:00
Hour	00:00:00	dAt2	70:01:01
rEC	OFF	Int2	00:15:00

6. RS-485 INTERFACE

DB16 programmable digital meters have a serial link of RS-485 standard to communicate in computer systems and with other devices fulfilling the master function. The MODBUS asynchronous character communication protocol has been implemented on the serial link. The transmission protocol describes information exchange procedures between devices through the serial link.

6.1. Procedure of the serial interface connection

The RS-485 standard enables the direct connection to 32 devices on a single serial link up to a 1200 m distance. For the connection of a higher number of devices it is necessary to apply additional intermediate-to-separating systems.

The exit of the interface line is presented in the service manual on the fig. 3.d. In order to obtain a correct transmission it is necessary to connect lines **A** and **B** in parallel to their equivalent lines in other devices.

The connection must be made with a shielded conductor. The shield must be connected to the protective terminal in one point.

The **GND** line serves to the additional protection of the interface line at long distance connections.

One must connect GND signals between devices and in one point to the protective terminal (that is not necessary for the interface correct operation).

To obtain the connection with the computer of IBM PC class, an RS-232 into RS-485 converter is necessary or an RS-485 interface card. The way of NA6 meter connection through the PD5 converter is shown on the fig. 3d.

The designation of transmission lines for the card in the PC computer depends on the card producer.

6.2. Description of the MODBUS protocol implementation

The implemented protocol is compatible with the PI-MBUS-300 Rev G Modicon Company specification.

Set of serial link parameters of meters in the MODBUS protocol:

- meter address - 1... 247
- baud rate - 2400, 4800, 9600 bit/s
- working mode - ASCII, RTU
- information unit - ASCII: 8N1, 7E1, 7O1
  - RTU: 8N2, 8N1, 8E1, 8O1
- maximal response time 500 ms

The serial link parameter configuration is described in the further part of the user's manual. It consists on the settlement of the baud rate (**bAud** parameter), device address (**Adr** parameter) and the type of information unit (**trYb** parameter).

Note:

Each meter connected to the communication network must have:

- a unique address, different from addresses of other devices connected in the network,
- an identical baud rate and information type.

6.3. Description of the MODBUS protocol functions

Following functions of the MODBUS protocol have been implemented in NA6 meters:

Function description Table 3

Code	*Meaning*
03 (03 h)	Read-out of n-registers
06 (06 h)	Recording of a single register
16 (10 h)	Recording of n-registers
17 (11 h)	Identification of the slave device

The maximal number of the registers for writing or readout by one order is equal 28.

Read-out of n-registers (code 03 h)

Function is inaccessible in the publication mode.

Example: readout of 2 registers beginning from the register with the address 1 DBDh (7613) in RTU mode.

Request:

Device address	Function	Register address Hi	Register address Lo	Number of registers Hi	Number of registers Lo	Check-sum CRC
01	03	1D	BD	00	02	52 43

Response:

Device address	Function	Number of bytes	Value from the register 1DBD (7613)				Value from the register 1DBE (7614)				Check-sum CRC
01	03	08	3F	80	00	00	40	00	00	00	42 8B

Record of values into the register (code 06h)

The function is accessible in the publication mode.

Example: record of the register of 1DBDh (7613) address in RTU mode.

Request:

Device address	Function	Register address Hi	Register address Lo	Value from the register 1DBD (7613)				Check-sum CRC
01	06	1D	BD	3F	80	00	00	85 AD

Response:

Device address	Function	Register address Hi	Register address Lo	Value from the register 1DBD (7613)				Check-sum CRC
01	06	1D	BD	3F	80	00	00	85 AD

Record into n-registers (code 10h)

The function is accessible in the publication mode

Example: record of two registers beginning from the register with 1DBDh (7613) address in RTU mode.

Request:

Device address	Function	Register address		Number of registers		Number of bytes	Value for the register 1DBD (7613)				Value for the register 1DBE (7614)				Check-sum CRC
		Hi	Lo	Hi	Lo										
01	10	1D	BD	00	02	08	3F	80	00	00	40	00	00	00	03 09

Response:

Device address	Function	Register address Hi	Register address Lo	Number of registers Hi	Number of registers Lo	Check-sum (CRC)
01	10	1D	BD	00	02	D7 80

Report identifying devices (code 11h) in RTU mode

Example: Data readout identifying the device for NA6 with a universal input.

Request:

Device address	Function	Checksum (CRC)
01	11	C0 2C

Response:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the type of device	Check-sum
01	11	08	82	FF	00XXXXX	

Device address - depending on the setpoint

Function - no of function 0x11

Number of bytes - 0x08

Device identifier - 0x82

Device state - 0xFF

Field depending on the device type - XXXXXX

Device name - no taken advantage in NA6 meters 00 X X X X X

Analogue output - field depending on the type of the analogue output
- 0x00 - lack of analogue output, X 00 X X X X
- 0x01 - voltage analogue output, X 01 X X X X
- 0x02 - current analogue output, X 02 X X X X

No. of the software program - software version implemented in the meter
- X X_ _ _ _4 - byte variable of float type

Check sum - 2 bytes in case of work in RTU mode
- 1 byte in case of work in ASCII mode

Example:
Work in **RTU** mode: e.g. **Mode = RTU 8N2** (value 0x02 in case of readout/record through the interface).
NA6 meter
Execution with a voltage analogue output: **00**,
No. of the software version: **1.00**,
Device address set on: **Adr = 0 x 01**,

For such a meter the frame has the following form:

Device address	Function	Number of bytes	Device identifier	Device state	Field depending on the device type	Check-sum (CRC)
01	11	08	82	FF	00 00 3F 80 00 00	BE C2

6.4. Register map of DB16 meters

Register map of NA6 meters Table 4.

Address range	***Type of value***	***Description***
7000-7200	Float (32 bits)	The value is placed in two successive 16-byte registers. Registers enclose the same data as 32-byte registers from the 7500 area. Registers are only for readout.
7200-7400	Float (32 bits)	The value is placed in two successive 16-bit registers. Registers enclose the same data as 32-bit registers from the 7600 area. Registers are only for readout.
7500-7600	Float (32 bits)	The value is placed in a 32-byte register. Registers are only for readout.
7600-7700	Float (32 bits)	The value is placed in a 32-bit register. Registers can be read out and recorded.

6.5. Registers for recording and readout

NA6 meter

The value is placed in two successive 16-bit registers enclosing the same data as 32-bit registers from the 7600 area	The value is placed in 32-bit registers	Symbol	Writing (w) Readout (r)	Range	Description	
7200	7600	**Identifier**	r	-	Device identifier	
					Value	
					82	NA6
7202	7601	**Channel number**	w/r	0...1	Number of the meter channel	
					Value	
					0	Channel 1
					1	Channel 2
7204	7602	**input**	w/r	0...14	Channel input type <Channel number>	
					Value	
					0	Pt100 RTD
					1	Pt500 RTD
					2	Pt1000 RTD
					3	J thermocouple
					4	K thermocouple
					5	N thermocouple
					6	E thermocouple
					7	R thermocouple
					8	S thermocouple
					9	T thermocouple
					10	R. meas. up to 10 kΩ
					11	Volt. meas. to ± 300 mV
					12	Volt. meas. to ± 600 V
					13	Current meas. to ± 40 mA
					14	Current meas. to ± 5 A

7206	7603	**LoIn**	w/r	-1999... 9999	Lower value of the input range < **Channel number** >
7208	7604	**HiIn**	w/r	-1999... 9999	Upper value of the input range < **Channel number** >
7210	7605	**Function**	w/r	0... 7	Operation function on channel < **Channel number** >

Value	
0	Switched off
1	Squaring
2	Extraction of roots
3	Re-recording from the channel
4	Addition of channels
5	Subtraction of channels
6	Multiplication of channels
7	Division of channels

7212	7606	**Compens.**	w/r	-199.9... 999.9	Compensation of the channel conductor resistance or cold junction < **Channel number** >
7214	7607	**D_P**	w/r	0... 4	Channel decimal point < **Channel number** >

Value	
0	0000
1	000.0
2	00.00
3	0.000
4	Auto

7216	7608	**Cnt**	w/r	0... 999.9	Channel measurement time < **Channel number** >
7218	7609	**Indi**	w/r	0... 1	Channel individual characteristic < **Channel number** >

Value	
0	Switched characteristic off
1	Switched characteristic on

7220	7610	**X1 In**	w/r	-1999... 9999	Parameters of the channel individual characteristic < **Channel number** >
7222	7611	**Y1 LED**	w/r	-1999... 9999	Parameters of the channel individual characteristic < **Channel number** >
7224	7612	**X2 In**	w/r	-1999... 9999	Parameters of the channel individual characteristic < **Channel number** >
7226	7613	**Y2 LED**	w/r	-1999... 9999	Parameters of the channel individual characteristic < **Channel number** >

7228	7614	**Bargraph number**	w/r	0... 1	Bargraph number	
					Value	
					0	Bargraph of channel 1
					1	Bargraph of channel 2
7230	7615	**Bargraph type**	w/r	0... 4	Bargraph type < **Bargraph Nr** >	
					Value	
					0	One-colour (**OnEC**)
					1	Change of colour after exceeding the alarm threshold (the colour change the whole bargraph) (**Intr**)
					2	Change of colour after exceeding the alarm threshold (Three-segment change of colour) (**SEct**)
					3	One-colour bargraph, alarm markers in another colour (**PInt**)
					4	Increasing/decreasing trend (**trEn**)
7232	7616	**Colour**	w/r	0... 7	Bargraph colour < **Bargraph Nr** >	
					Value	
					0	Bargraph off (**OFF**)
					1	Red (**r**)
					2	Green (**G**)
					3	Red + Green (**rG**)
					Other values are only accessible in meters with RGB diodes	
					4	Blue (b)
					5	Red + Blue (rb)
					6	Green + blue (Gb)
					7	Red + Green + Blue (rGb)
7234	7617	**Brl**	w/r	-1999... 9999	„Magnifier" on the bargraph < **Bargraph Nr** >. Lower threshold	
7236	7618	**Brh**	w/r	-1999... 9999	„Magnifier" on the bargraph < **Bargraph Nr** >. Upper threshold	

7238	7619	**Alarm number**	w/r	0... 7	Choice of alarm number	
					Range of changes is depended on the meter execution code (number of alarms)	
7240	7620	**Ch_Alarm**	w/r	0... 1	Channel number on which the alarm is to react < **Alarm Nr** >	
					Value	
					0	Channel 1
					1	Channel 2
7242	7621	**Prl**	w/r	-1999... 9999	Alarm lower threshold <**Alarm No**>	
7244	7622	**Prh**	w/r	-1999... 9999	Alarm upper threshold <**Alarm No**>	
7246	7623	**Type a**	w/r	0... 4	Alarm type <**Alarm No**>	
					Value	
					0	Normal
					1	Switched on
					2	Switched off
					3	Manually switched on
					4	Manually switched off
7248	7624	**Alarm delay**	w/r	0... 999.9	Alarm delay <**Alarm No**>	
7250	7625	**Alarm support**	w/r	0... 1	Alarm signalling support <**Alarm No**>	
					Value	
					0	Support switched off
					1	Support switched on
7252	7626	**CURL**	w/r	0... 7	Bargraph colour to the lower alarm threshold < **Alarm Nr** >	
					Value	
					0	Bargraph switched off (**OFF**)
					1	Red (**r**)
					2	Green (**G**)
					3	Red + Green (**rG**)
					Other values accessible only in meters with RGB diodes	
					4	Blue (**b**)
					5	Red + Blue (**rb**)
					6	Green + blue (**Gb**)
					7	Red + Green + Blue (**rGb**)

7254	7627	**CURH**	w/r	0... 7	Bargraph colour after exceeding the upper alarm threshold <**Alarm No**>	
					Value	
					0	Bargraph switched off (**OFF**)
					1	Red (**r**)
					2	Green (**G**)
					3	Red + Green (**rG**)
					Other values accessible only in meters with RGB diodes	
					4	Blue (**b**)
					5	Red + Blue (**rb**)
					6	Green + blue (**Gb**)
					7	Red + Green + Blue (**rGb**)
7256	7628	**Chna**	w/r	0... 1	Choice of channel number for analogue output	
					Value	
					0	Channel 1
					1	Channel 2
7258	7629	**Output characteristic**	w/r	0... 1	Characteristic of the analogue output	
					Value	
					0	Characteristic switched off
					1	Characteristic switched on
7260	7630	**X1 LED**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7262	7631	**Y1 Out**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7264	7632	**X2 LED**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7266	7633	**Y2 Out**	w/r	- 1999... 9999	Parameters of the analogue output characteristic	
7268	7634	**Baud rate**	w/r	0... 2	Baud rate of the RS-485 interface	
					Value	
					0	2400 bit/s
					1	4800 bit/s
					2	9600 bit/s
7270	7635	**Working mode**	w/r	1... 7	Working mode of the MODBUS protocol	
					Value	
					1	ASCII 8N1
					2	ASCII 7E1
					3	ASCII 7O1
					4	RTU 8N2

					5	RTU 8E2
					6	RTU 8O2
					7	RTU 8N1
7272	7636	**Address**	w/r	0... 247	Choice of the device address	
7274	7637	**Test**	w/r	0... 1	Test of the display	
					Value	
					0	Lack of operation
					1	Test
7276	7638	**Hour**	w/r	0... 23.5959	Current time	
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds In case when introducing and incorrect time, the indicator will correct it automatically.	
7278	7639	**Recording**	w/r	0... 3	Registration of measured value	
					Value	
					0	Recording switched off
					1	Recording from channel 1
					2	Recording from channel 2
					3	Recording from channel 1 and 2
7280	7640	**Interval**	w/r	0... 99.5959	Time interval of the recording < **Channel number** >	
7282	7642	**Recording time**	w/r	0... 23.5959	Time of the recording start < **Channel number** >	
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds In case when introducing and incorrect time, the indicator will correct it automatically.	
7284	7642	**Year**	w/r	1970... 2038	Year of the recording start < **Channel number** >	
7286	7643	**Month**	w/r	1... 12	Month of the recording start < **Channel number** >	

7288	7644	**Day**	w/r	1... 31	Day of the recording start < **Channel number** >
					Year, **Month**, **Day** are information parameters (they do not serve to define the date from which the recording is to be start).
7290	7645	**Erasing of minimum Channel 1**	w/r	0... 1	Erasing of the channel 1 minimal value
					Value 0 Lack of operation 1 Erasing
7292	7646	**Erasing of maximum Channel 1**	w/r	0... 1	Erasing of the channel 1 maximal value
					Value 0 Lack of operation 1 Erasing
7294	7647	**Erasing of minimum Channel 2**	w/r	0... 1	Erasing of the channel 2 minimal value
					Value 0 Lack of operation 1 Erasing
7296	7648	**Erasing of minimum Channel 2**	w/r	0... 1	Erasing of the channel 2 maximal value
					Value 0 Lack of operation 1 Erasing

7320	7660	**Year of the memorised value**	w/r	1970... 2038	Year of memorised value in memory < **Channel number** >
7322	7661	**Month of the memorised value**	w/r	1... 12	Month of memorised value in memory < **Channel number** >
7324	7662	**Day of the memorised value**	w/r	1... 31	Day of memorised value in memory < **Channel number** >

7326	7663	**Time of the memorised value**	w/r	0... 23.5959	Time of memorised value in memory < **Channel number** >
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds In case when introducing and incorrect time, the meter will correct it automatically.
7328	7664	**Index of the memorised value**	w/r	1... 750	Number of memorised value in memory < **Channel number** >
7230	7665	**Status**	w/r	0... 7	Operation status on the buffer < **Channel number** >

Value	
0	Lack of operation
1	Searching acc. date and time (registers nr 7660...7663 and 7320...7326)
2	Searching acc. time (registers nr 7663 and 7326)
3	Searching acc. index (registers nr 7664 and 7328)
4	Load next values into the buffer (registers7672...7691and 7344...7382)
5	Load previous values into the buffer (registers7672...7691 and 7344...7382)
6	Go to the first memorised value in memory.
7	Go to the last memorised value in memory.

7332	7666	**Number of the memorised value**	r	0... 750	Number of memorised value in memory, placed in the first register of the buffer <channel number>	
					Value	
					0	Memory is empty
					1... 750	Number of the memorised value
7334	7667	**Number of recorded registers**	r	0... 750	Number of recorded buffer registers <channel number>	
					Value	
					0	Buffer is empty
					1... 750	Number of recorded registers
7336	7668	**Year**	r	1970... 2038	Year for the value in the first register <channel number>	
7338	7669	**Month**	r	1... 12	Month for the value in the first register <channel number>	
7340	7670	**Day**	r	1... 31	Day for the value in the first register <channel number>	
7342	7671	**Time**	r	0... 23.5959	Time for the value in the first register <channel number>	
					This parameter occurs with four places after the decimal point in format gg,mmss, where: gg - means hours, mm - means minutes, ss - means seconds	
7344...7382	7672... 7691	**Buffer**	r	–	Memorised values, read off from the memory <channel number>	
					20 registers , including 20 memorised values.	

1) In case of registers not occurring in the given meter series, their value is:1E+20

6.6. Registers only for readout

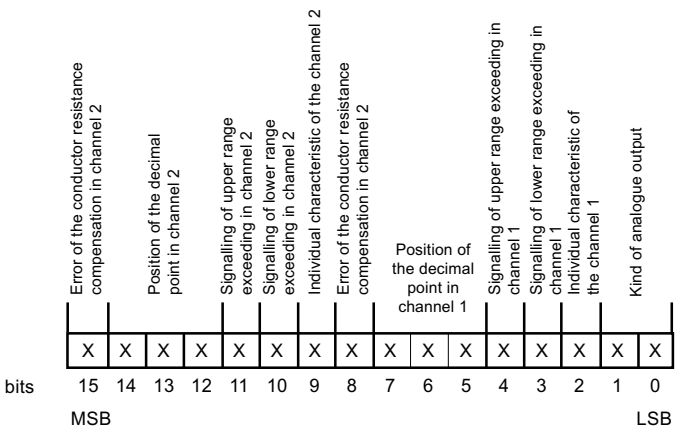
The value is placed into two successive 16-bite registers. These registers include the same data as 32-bite registers from the area 7500.	The value is placed into 32-bite registers	Name	Writing (w) Readout (r)	Unit	Quantity name
7000	7500	**Identifier**	r	-	Constant identifying the device
7002	7501	**Status 1**	r	-	Register describing the current state of the meter
7004	7502	**Status 2**	r	-	Register describing the current state of the meter
7006	7503	**Steering out**	r	%	It is the register defining the control procedure of the analogue output (controllability)
7008	7504	**Min 1**	r	-	Minimal value of the currently measured value of channel 1
7010	7505	**Max 1**	r	-	Maximal value of the currently measured value of channel 1
7012	7506	**Value 1**	-	-	Currently measured value of channel 1
7014	7507	**Hour**	-		Current time
7016	7508	**Min 2**	r	-	Minimal value of the currently measured value of channel
7018	7509	**Max 2**	r	-	Maximal value of the currently measured value of channel 2
7020	7510	**Value 2**	r	-	Currently measured value of channel 2

[1)] In case of registers no occurring in the given meter series, their values is 1E+20

Note !

– At the moment of exceeding the upper or lower range, „displayed value", „minimum", „maximum" parameters are set on the value 1E+20.
– For the parameter **Cnt**=0 (Measurement switching off and display of the current time), „minimum", „maximum" and „displayed value" parameters are set on the value 1E+20.

Description of the Status 1 register



Bit-15 Error of the conductor resistance compensation in channel 2

0 - Lack of error

1 - Signalling of compensation error

Bit-14...12 Position of the decimal point in the channel 2

000 - lack

001 - 000,0

010 - 00,00

011 - 0,000

100 - Auto

Bit-11 Signalling of the upper range exceeding of the channel 2

0 - normal work

1 - range exceeding

Bit-10 Signalling of the lower range exceeding of the channel 2

0 - normal work

1 - range exceeding

Bit-9 Individual characteristic of the channel 2

0 - individual characteristic switched off

1 - individual characteristic switched on

Bit-8 Error of the conductor resistance compensation in the channel 1

0 - lack of error

1 - signalling of the compensation error

Bit-7... 5 Position of the decimal point in the channel 1

000 - lack

001 - 000,0

010 - 00,00

011 - 0,000

100 - Auto

Bit-4 Signalling of the upper range exceeding of the channel 1

0 - normal work

1 - range exceeding

Bit-3 Signalling of the lower range exceeding of the channel 1

0 - normal work

1 - range exceeding

Bit-2 Individual characteristic of the channel 1

0 - individual characteristic switched off

1 - individual characteristic switched on

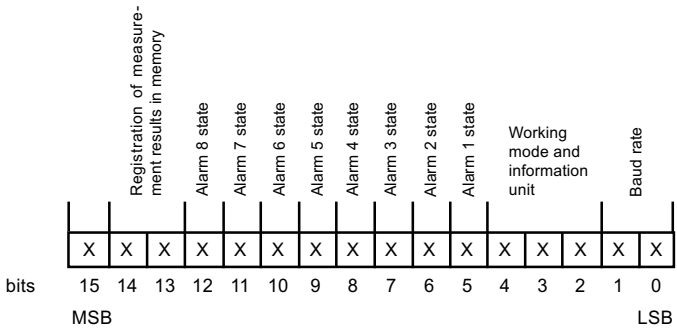
Bit-1...0 Kind of output (voltage, current)

00 - lack of analogue output

01 - current

10 - voltage

Description of the status 2 register



Bit-15. No used

Bit-14...13 Record of measurement results in memory

0 - Registration switched off

0 - Registration from the channel 1

1 - Registration from the channel 2

1 - Registration from the channel 1 and 2

Bit-12 State of alarm 8

0 - off

1 - on

Bit-11 State of alarm 7

0 - off

1 - on

Bit-10 State of alarm 6

0 - off

1 - on

Bit-9 State of alarm 5

0 - off

1 - on

Bit-8 State of alarm 4

0 - off

1 - on

Bit-7. State of alarme 3

0 - off

1 - on

Bit-6 State of alarm 2

0 - off

1 - on

Bit-5 State of alarm 1

0 - off

1 - on

Bit-4...2 Working mode and information unit

000 - interface switched off

001 - 8N1 - ASCII

010 - 7E1 - ASCII

011 - 7O1 - ASCII

100 - 8N2 - RTU

101 - 8E1 - RTU

110 - 8O1 - RTU

111 - 8N1 - RTU

Bit-1...0 Baud rate

00 - 2400 bit/s

01 - 4800 bit/s

10 - 9600 bit/s

7. TECHNICAL DATA

INPUTS:

Pt100	(- 200... + 850)°C	
Pt500	(- 200... + 850)°C	
Pt1000	(- 200... + 850)°C	
J (Fe-CuNi)	(- 100... + 1100)°C	
K (NiCr-NiAl)	(-100... + 1370)°C	
N (NiCrSi-NiSi)	(- 100... + 1300)°C	
E (NiCr-CuNi)	(- 100... + 850)°C	
R (PtRh13-Pt)	(0... + 1760)°C	
S (PtRh10-Pt)	(0... + 1760)°C	
T (Cu-CuNi)	(- 50... + 400)°C	
Resistance measurement	0... 10 kΩ	
Voltage measurement	± 300 mV,	input resistance > 9 MΩ ,
Voltage measurement	± 600 V,	input resistance > 4.2 MΩ
Current measurement	± 40 mA,	input resistance < 4 Ω
Current measurement	± 5 A,	input resistance = 10 mΩ ± 10%

Measuring subranges (preserving the class):

Pt100	320°C
Pt500	230°C
Pt1000	290°C
Thermocouple J	350°C, 700°C
Thermocouple K	450°C, 950°C
Thermocouple N	550°C, 1000°C
Thermocouple E	250°C, 520°C
Resistance	110 Ω , 220 Ω , 460 Ω , 950 Ω , 2100 Ω , 5000 Ω
Voltage	19 mV, 35 mV, 75 mV, 155 mV, 5 V, 11 V, 22 V, 45 V, 90 V, 180 V, 360 V
Current:	5 mA, 11 mA, 23 mA, 1.8 A, 3.8 A

Intensity of current flowing through the resistance thermometer: < 400 μA

Resistance of conductors linking the resistance thermometer with the meter: < 20 Ω /1 wire

Thermocouple characteristics acc. EN 60584-1.

Resistance thermometer characteristics acc. IEC 751+A1+A2.

OUTPUTS:

– **Analogue outputs** galvanically isolated, with a resolution = 0,025% of the range

- current programmable: 0/4...20 mA	load resistance ≤ 500 Ω
- or voltage programmable: 0...10 V	load resistance ≥ 500 Ω
- output response time	100 ms
- output error	0.2% of the range
- additional error due to ambient temperature changes:	± (0.1% of the range/10K)

– **Relay output**

4 relays; voltageless make contacts - maximal load:

voltage	250 V a.c., 150 V d.c.,
current	5 A 30 V d.c., 250 V a.c.,
resistance load	1250 VA, 150 W.

Programmable alarm thresholds;
Three types of alarms;
Hysteresis defined by means of the lower and upper alarm threshold;
Signalling of alarm operation on the bargraph;

– **8 outputs of open collector (OC) type**

voltageless, OC type with npn transistor (max. load 25 mA)
range of connected voltage: 5...30 V d.c.

– **Digital output:**

interface:	RS-485,
transmission protocol:	MODBUS,
ASCII:	8N1, 7E1, 7O1,
RTU:	8N2, 8E1, 8O1, 8N1,
baud rate:	2400, 4800, 9600 baud
maximal response time to the request frame:	500 ms.

Additional supply output 24 V d.c., maximal load 30 mA

Memory parameters:

- meter memory (recording)	750 samples (channel 1 or channel 2), or 375 samples (channel 1) + 375 samples (channel 2)
- min. record interval	1 sec;

Basic error:	0.1% of measuring range ±1 digit 0.2% of measuring range ±1 digit (for thermocouples R, S, T)
Additional errors in nominal working conditions when measuring the temperature:	
- compensation of reference junction temperature changes	± 1°C
- compensation of conductor resistance changes	± 0.1% of the range
- from ambient temperature changes	± (0.05% of the range/10K)
Averaging time	min 200 ms/channel min 500 ms/channel (temperature ranges)
Rated operation conditions:	
- supply voltage depending on the execution code	95...230...253 V a.c./d.c. 20...24...40 V a.c./d.c.
- supply a.c. voltage frequency	40...50/60...440 Hz
- ambient temperature	- 10...23...55°C
- storage temperature	- 25...+85°C
- relative humidity	< 95% (no condensation)
- pre-heating time:	
- meter to co-operate with thermocouples, the automatic compensation is switched on	1 hour
- other meter' executions	10 min.
Sustained overload:	
- thermocouples, resistance thermometers	1 %
- measurement of voltage, current and resistance	10 %
Momentary overload (3 s):	
- sensor and voltage inputs 300 mV	10 V
- voltage input > 2,5 V	10 × Un (< 1000 V)
- current input	10 × In

Readout field (depending on execution):	2 x 4 LED seven-segment LED display, character height: 7 mm indication range: -1999...9999 bargraph length: 88 mm - 48 segments in three-colour execution - 27 segments in seven-colour execution
Bargraph resolution	programmable
Bargraph accuracy	± 0.5 segment
Servicing	three keys:
Ensured protection degree:	
- through the casing	IP 50
- from terminal side	IP 20
Overal dimensions	48 x 144 x 100 mm (with terminals)
Weight:	< 0.4 kg
Power consumption	< 13 VA
Resistance against supply decay:	acc. EN 61000-6-2
Electromagnetic compatibility:	
- immunity	EN 61000-6-2
- emission	EN 61000-6-4 (industrial environment)
Safety requirements according EN 61010-1:	
- installation category	III
- pollution degree	2
- phase-to-earth max. working voltage:	
- input	600 V
- supply	300 V
- relays	300 V
- analogue output	50 V
- RS-485	50 V

8. BEFORE A FAILURE WILL BE DECLARED

In case of incorrect symptoms please to acquaint with the table below.

SYMPTOMS	PROCEDURE
1. Lack of indications on the display. The bargraph indicates nothing.	Check the connection of the feeder cable.
2. The time is displayed on the display, e.g. **H_12** alternately with **34:43**.	The number of measurements **Cnt** = 0 has been introduced. The meter is working in the SLEEP mode. It displays the current hour.
3. Marks or are displayed on the display.	Check the correctness of the input signal connection. See the service manual. Check also the setting of parameters **D_P**, **Ind**, **LoIn** and **HiIn**.
4. A signal inconsistent with our expectations occurs on the meter analog output.	One must check if the load resistance of the analogue output is in accordance with technical data. Check if the individual characteristic is not switched on. In case of necessity make changes of individual characteristic parameters or introduce manufacturer parameters **Set**.
5. Lack of possibility to enter into the programming mode. The inscription **Err** is displayed.	The programming mode is protected by a password. When the user forgets which password has been introduced, he should contact by phone the manufacturer or the nearest authorised workshop.

6. Lack of certainty if all segments of the display or bargraph are efficient.	Enter into the programming matrix and switch the display and bargraph **tSt** test on. Character fields are lighted successively from 0000 to 9999. In the same time the bargraph is lighted with successive colours. If some of segments are not lighted or diodes have different colours, one must submit these defects to the nearest workshop.
7. During the operation in the programming mode, parameter values inconsistent with the range of changes given in the table 1, appear on the display.	Enter into the programming matrix and accept the **SEt** parameter. The meter will introduce values in accordance with the table 2.
8. A result inconsistent with our expectations appears on the display.	Check if the individual characteristic is not switched on. In case of necessity enter into the programming matrix and accept the **SEt** parameter. The meter will introduce parameters in accordance with the table 2.
9. The bargraph does not work in accordance with our expectations.	Check bargraph parameters. In case of a further incorrect operation, enter into the programming matrix and accept the parameter **SEt**. Switch the display and bargraph **tSt** test on.
10. Despite the exceeding of the alarm threshold the alarm relay does not switch on.	Check the delay of alarm operation introduced into the meter. In case of need, correct **dLY** parameters.
11. The meter, instead of displaying the measurement result, displays the parameter symbol and its value.	The meter is working in the preview mode or in the programming mode. Press the escape key .
12. Despite of the introduced delay in the alarm operation, e.g. 30 seconds, but the alarm after this time did not operate.	The lasting alarm state was shorter than the programmed, that means that during the lasting time, the alarm withdrawal state occurred. In such a case, the meter begins to count down the time from the beginning.
13. The meter does not establish the communication with the computer through the RS-485 interface.	Check if interface conductors (**A**, **B**, **GND**) were correctly connected. Then, check in the programming matrix the setting of the interface (**bAud**, **trYb**, **Adr**). These parameters must be the same as in the used software.

9. EXAMPLES OF NA6 METER PROGRAMMING

Example 1. Programming of the individual characteristic.

If we want to programme so that to the value 4.00 mA will correspond the value 0 on the display, whereas the value 100, to the value 20.00 mA, one must:

- enter into the programming mode and choose the **D_ P** parameter responsible for the decimal point. Set the decimal point on **00000**
- choose the **Ind** parameter and switch the individual characteristic **On**
- choose the **I_H1** parameter and introduce the value 4.00
- transit on the **d_Y1** parameter and introduce the value 0
- transit on the **I_H2** parameter and introduce the value 20.00
- transit on the **d_Y2** parameter and introduce the value 100

Example 2 Programming of an inverse individual characteristic.

If we want to programme so that to the value 4.00 mA will correspond the value 120.5 on the display, and the value 10.8, to the value 20.00 mA, one must:

- enter into the programming mode and choose the **D_P** parameter responsible for the decimal point. Set the decimal point on **0000.0**
- choose the **Ind** parameter and switch the individual characteristic **On**
- choose the **I_H1** parameter and introduce the value 4.00
- transit on the **d_Y1** parameter and introduce the value 120.5
- transit on the **I_H2** parameter and introduce the value 20.00
- transit on the **d_Y2** parameter and introduce the value 10.8

Example 3 Programming of the alarm with hysteresis

If we want to programme the alarm 1 operation so that at the value 850°C in the channel 1, this alarm will be switched on, whereas it will be switched off at the value 100°C, and the alarm 2 operation so that at the value 1000°C in the channel 2, this alarm will be switched off and switched on at the value -199°C, one must:

- enter into the programming mode, choose the **ChnA** parameter of the alarm 1 and choose the channel 1: **Ch1**
- enter into the programming mode , choose the **PrL** parameter of the alarm 1 and introduce the value 100
- transit on the **PrH** parameter of the alarm 1 and introduce the value 850
- transit on the **tYPA** parameter of the alarm 1 and choose the function assigned as **nor**

- enter into the programming mode, choose the **ChnA** parameter of the alarm 2 and choose the channel 2: **Ch2**
- choose the **PrL** parameter of the alarm 2 and introduce the value 1000
- transit on the **PrH** parameter of the alarm 2 and introduce the value -199
- transit on the **tYPA** parameter of the alarm 2 and select the function **nor**

Example 4 Programming of an alarm operating in a set interval with delay.

If we want that the alarm 1 will be switched on in the interval from 100 V to 300 V for the channel 1 and operate only after 10 seconds, one must:

- enter into the programming mode , choose the **ChnA** parameter of the alarm 1 and choose the channel 1: Ch1
- enter into the programming mode, choose the **PrL** parameter of the alarm 1 and introduce the value 100
- transit on the **PrH** parameter of the alarm 1 and introduce the value 300
- transit on the **tYPA** parameter of the alarm 1 and select the function **On**
- transit on the **dLY** parameter of the alarm 1 and introduce the value 10.0

in case of the alarm state duration for a time longer than 10 seconds, the meter will switch the alarm relay on

Example 5 Programming of an analog output

If we want to programme so that to the displayed value 0.00 mA for the channel 2 will correspond the value 4.00 on the analogue output, whereas to the value 20.00 mA , the value 20.00 mA, one must:

- enter into the programming mode, choose the **ChnO** parameter and choose the channel 2: **Ch2**
- enter into the programming mode, choose the **IndO** parameter and switch the individual characteristic **On**
- choose the **d_H1** parameter and introduce the value 0.00
- transit on the **O_Y1** parameter and introduce the value 4.00
- transit on the **d_H2** parameter and introduce the value 20.00
- transit on the **O_Y2** parameter and introduce the value 20.00

Example 6 Bargraph programming

If we want to programme so that the bargraph 1 was of a ,,sector" type - red colour between PrL and PrH parameters, and the bargraf 2 of a „trend" type - green colour between PrL and PrH parameters - one must:

- enter into the programming mode , choose the **tYPb** parameter of the bargraph 1 and choose **SEct**

- choose the **coLr** parameter of the bargraph 1 and choose **r**
- choose the **tYPb** parameter of the bargraph 2 and choose **trEn**
- choose the **coLr** parameter of the bargraph 2 and choose **G**

Example 7 Programming of a bargraph with a ,,magnifier" on the bargraph.

If we want to programme so that the bargraph 1 was blank for the value 0 and is to be full lighted for the value 150, whereas the bargraph 2 is to be blank for the value 25.5, and fully lighted for the value 500.2, one must:

- enter into the programming mode , choose the **brL** parameter of the bargraph 1 and introduce the value 0
- choose the **brH** parameter of the bargraph 1 and introduce the value 150
- Choose the **brL** parameter of the bargraph 2 and introduce the value 25.5
- Choose the **brH** parameter of the bargraph 2 and introduce the value 500.2

Example 8 Programming of the channel 1 recording, every 20 sec, from 12:30 and channel 2 recording, every 5 minutes, from 14:00,

- enter into the programming mode, choose the **Gor1** parameter and introduce the value 12:30,
- transit into **Int1** parameter and introduce the value 00:00:20,
- enter into the programming mode, choose the **Gor2** parameter and introduce the value 14:00,
- transit into **Int2** parameter and introduce the value 00:05:00,
- choose the **rEc** parameter and switch **rE12** recording on,

After exiting from the programming matrix, the memory will be erased and the meter begins to record results from the channel 1, from 12:30, every 20 second and from the channel 2, from 14:00, every 5 minutes.

The meter switches the recording off in the channel in which the filling of the memory follows.

10. ORDERING PROCEDURE

Table 5

NA6 METER WITH BARGRAPHS	X	XX	X	X	X	X	X	X	XX	X

Bargraph colour:
3 colours (R, G, R + G) ..... **T**
7 colours (R, G, B, R+G, R+B, G+B, R+G+B) ... **M**

Display colour (on channels 1 and 2):
without displays* **00**
red - red ..... **RR**
red - green ..... **RG**
red - blue ..... **RB**
green - red ..... **GR**
green - green ..... **GG**
green - blue ..... **GB**
blue - red ..... **BR**
blue - green ..... **BG**
blue - blue ..... **BB**

Input signal:
universal input (table 6) ..... **U**
on order** ..... **X**

Analogue output signal:
without output **0**
current programmed, 0/4...20 mA **1**
voltage programmed, 0...10 V **2**
on order** ..... **X**

Digital output signal:
without output **0**
RS-485 digital output **1**

Additional outputs:
without output **0**
4 relays outputs **4**
8 OC outputs **8**
on order** ..... **X**

Supply:
95...253 V a.c./d.c. **1**
20... 40 V a.c./d.c. **2**
on order** ..... **X**

Kind of terminals:
socket - screw plug **0**
on order*** ..... **X**

Execution:
standard **00**
custom-made** ..... **XX**

Acceptance test:
without a quality inspection certificate **0**
with an extra quality inspection certificate **1**
according customer's agreement ** ..... **X**

Notes: *) In the meter without displays, one must order the RS-485 digital output execution.
**) The manufacturer assigns the execution code.
***) Available execution with self-locking sockets.

Example of NA6 ordering:

Code: NA6 M GB U 1 1 4 1 0 00 0 means:

M - NA6 meter with two 7-colour bargraphs,

GB - digital LED displays of green colour in the channel 1 and blue colour in the channel 2,

U - universal input (table 6),

1 - current analogue output signal 0/4...20 mA,

1 - RS-485 digital output signal,

4 - additional outputs consisting of 4 relays,

1 - supply: 95...253 V a.c./d.c.,

0 - socket-screw plug terminals,

00 - standard execution,

0 - without a quality inspection certificate.

In case of a custom-made execution or if you need some more additional technical information, please write to or phone our Export Department.

Input signals — Table 6

Universal input	Resistance thermometer:	
	Pt100	(- 200... +850)°C
	Pt500	(- 200... +850)°C
	Pt1000	(- 200... +850)°C
	Thermocouple:	
	J (Fe-CuNi)	(- 100... +1100)°C
	K (NiCr-NiAl)	(- 100... +1370)°C
	N (NiCrSi-NiSi)	(- 100... +1300)°C
	E (NiCr-CuNi)	(- 100... +850)°C
	R (PtRh13-Pt)	(0... +1760)°C
	S (PtRh10-Pt)	(0... +1760)°C
	T (Cu-CuNi)	(- 50... +400)°C
	Resistance	0... 10 kΩ
	Voltage	± 300 mV
	Voltage	± 600 V
	current	± 40 mA
	current	± 5 A

11. MAINTENANCE AND GUARANTEE

The NA6 meter does not require any periodical maintenance. In case of some incorrect unit operations:

1. From the shipping date, during the period given in the annexed guarantee card

One should take the meter down from the installation and return it to the Manufacturer's Quality Control Dept.

If the unit has been used in compliance with the instructions, the Manufacturer guarantees to repair it free of charge.

2. After the guarantee period:

One should turn over the meter to repair in a certified service workshop.

The disassembling of the housing causes the cancellation of the granted guarantee.

Spare parts are available for the period of five years from the date of purchase.

The Manufacturer policy is one of continuous improvement and we reserve the right to make changes in design and specification of any products as engineering advances or necessity requires and revise the above specification without notice.

SALES PROGRAMME

- DIGITAL PANEL METERS
- BARGRAPH INDICATORS
- MEASURING TRANSDUCERS
- ANALOGUE PANEL METERS (DIN INSTRUMENTS)
- DIGITAL CLAMP-ON METERS
- PROCESS and HOUSEHOLD CONTROLLERS
- CHART and SCREEN RECORDERS
- POWER CONTROL UNITS and FREQUENCY INVERTERS
- AUTOMOTIVE DASHBOARD INDICATORS
- STATIONARY and PORTABLE CALIBRATORS
- MEASUREMENT ACCESSORIES (SHUNTS, SENSORS, TRANSFORMERS)
- MEASURING SYSTEMS (ENERGY, HEAT, CONTROL, MEASUREMENT)
- CUSTOM-MADE PRODUCTS

WE ALSO OFFER OUR SERVICES IN THE PRODUCTION OF:

- ALUMINIUM ALLOY PRESSURE CASTINGS
- PRESSURE CASTING DIES AND INJECTION MOULDS
- PRECISION ENGINEERING AND THERMOPLASTICS PARTS

QUALITY PROCEDURES:

According ISO 9001 international requirements.
All our instruments have CE mark.
For more information, please write to or phone our Export Department.

LUMEL

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